

2 Sheets—Sheet 1.

No. 333,799.

Patented Jan. 5, 1886.

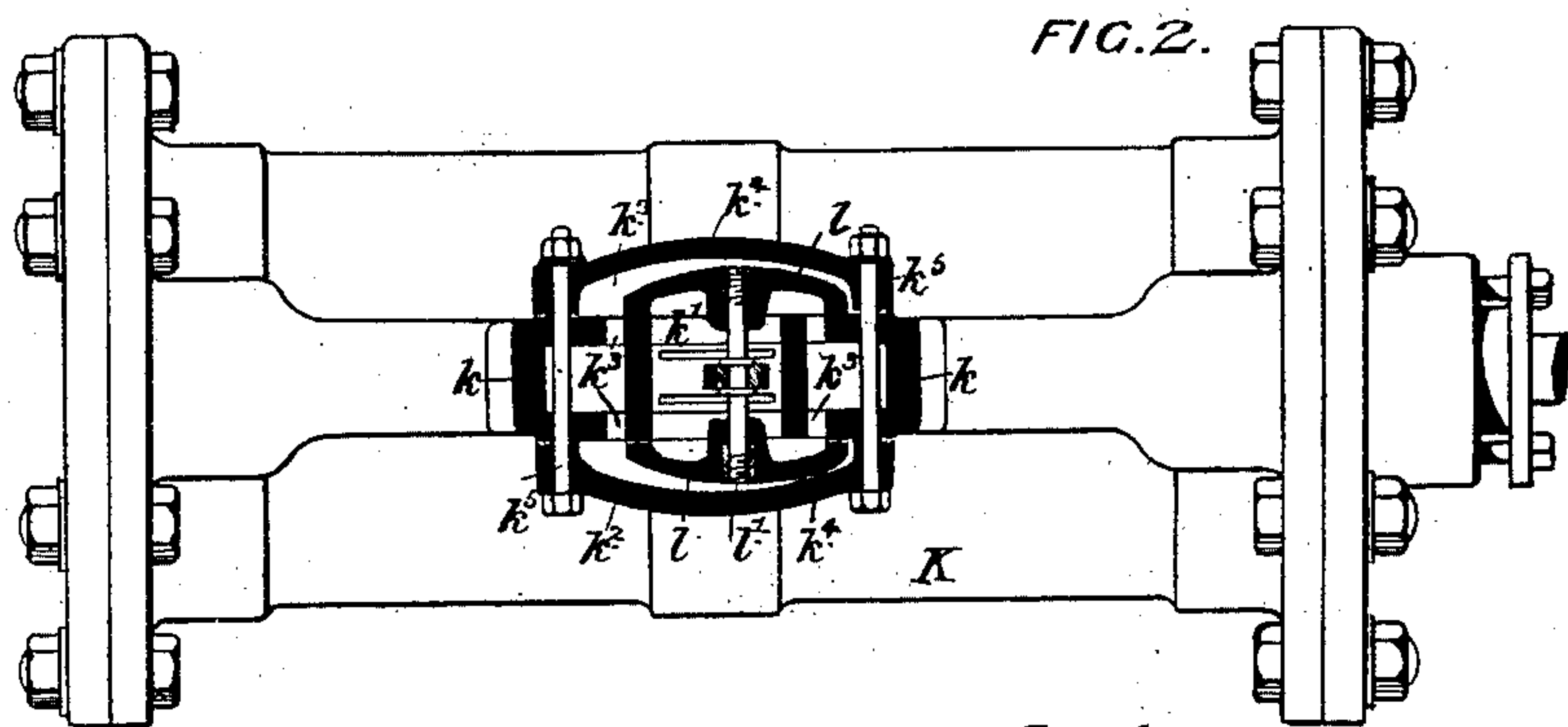


FIG. 2.

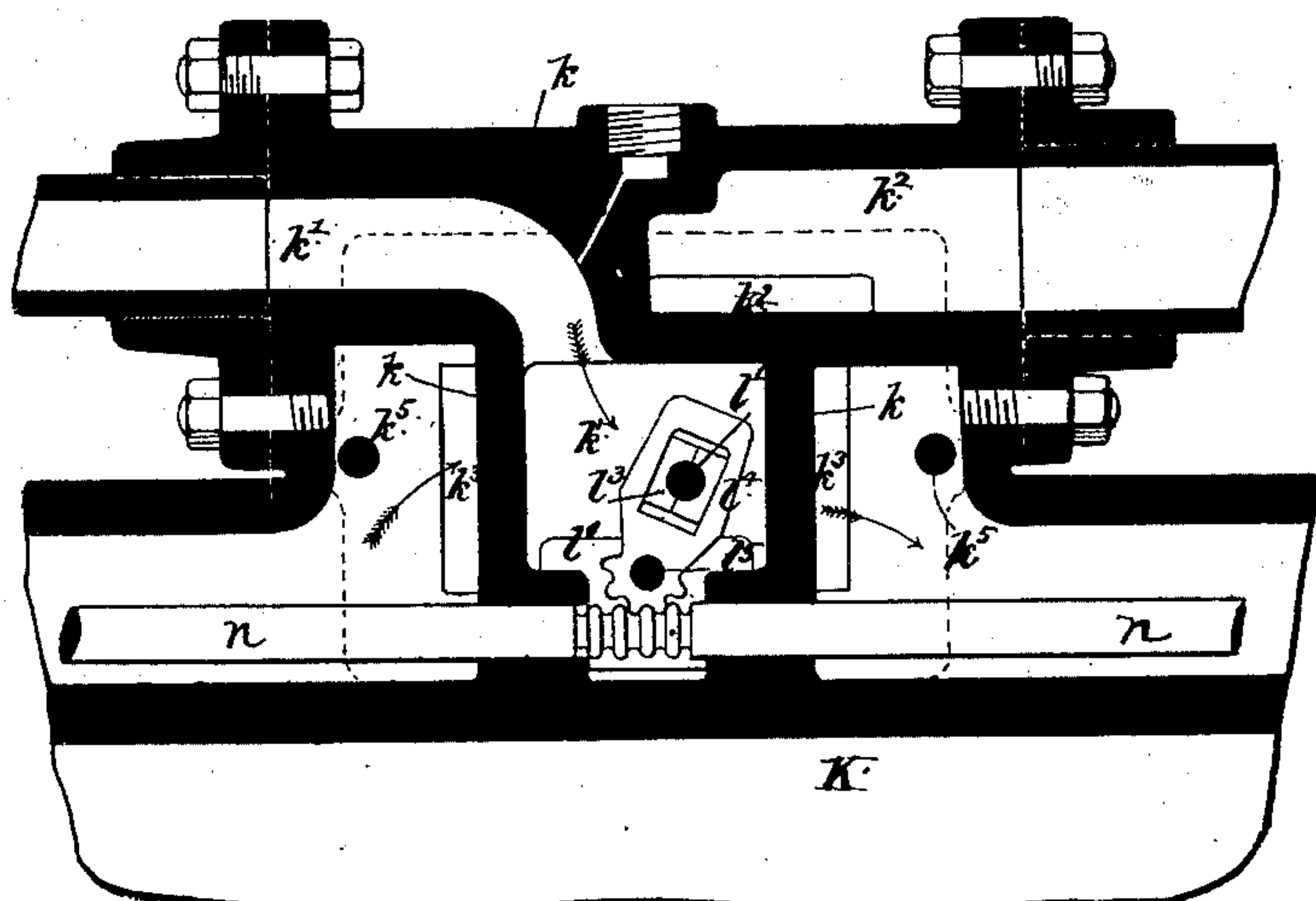


FIG. 4.

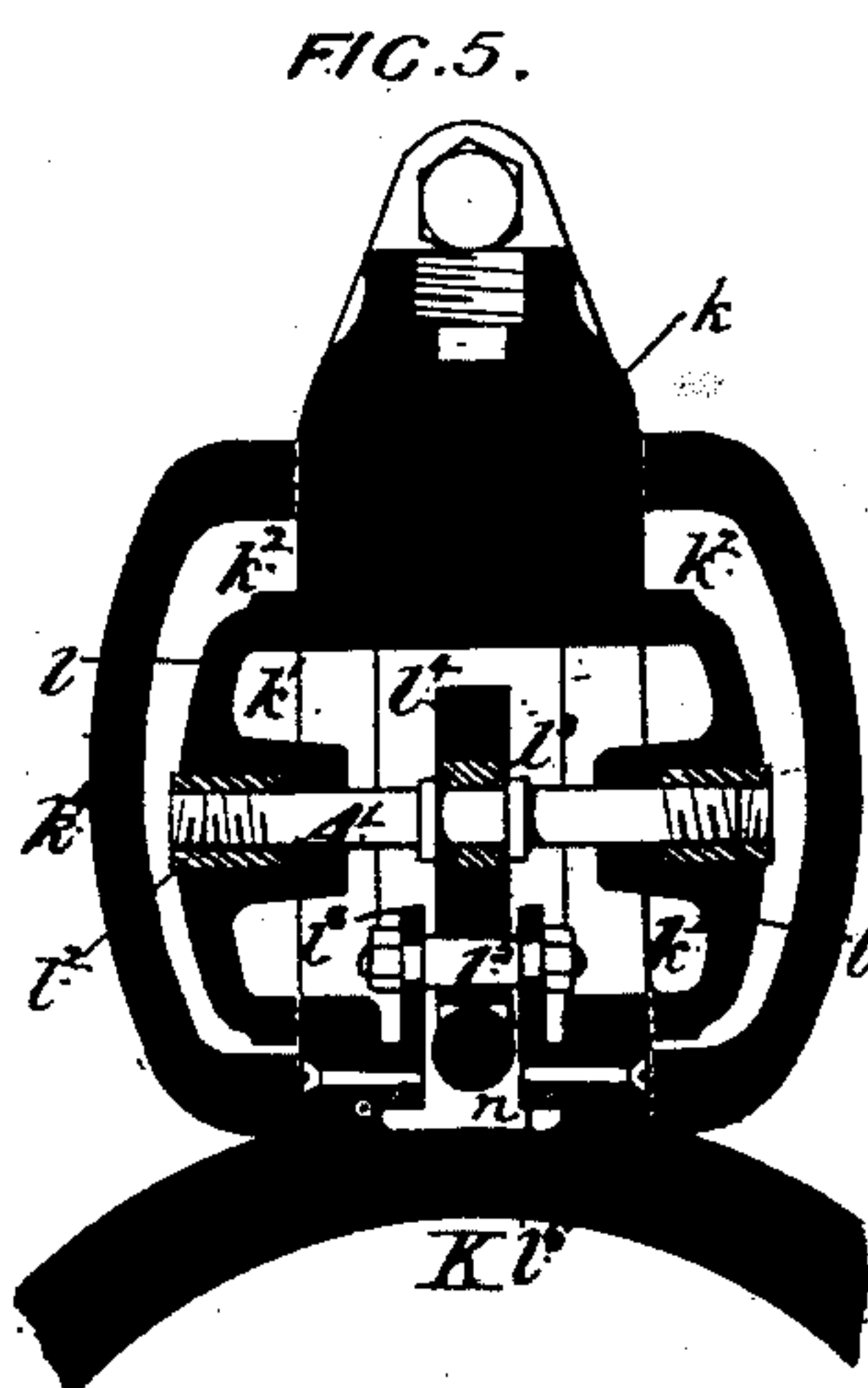


FIG.5.

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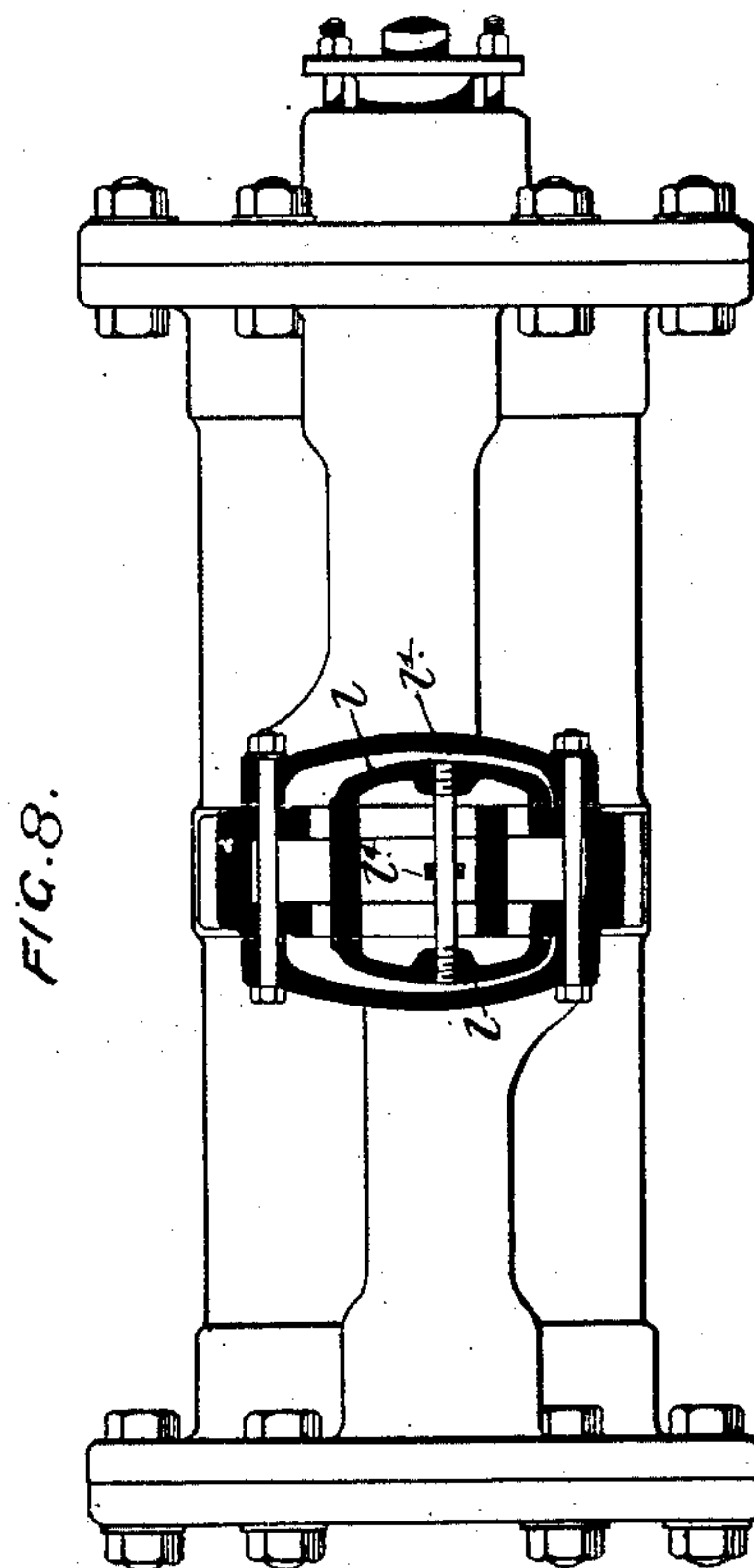
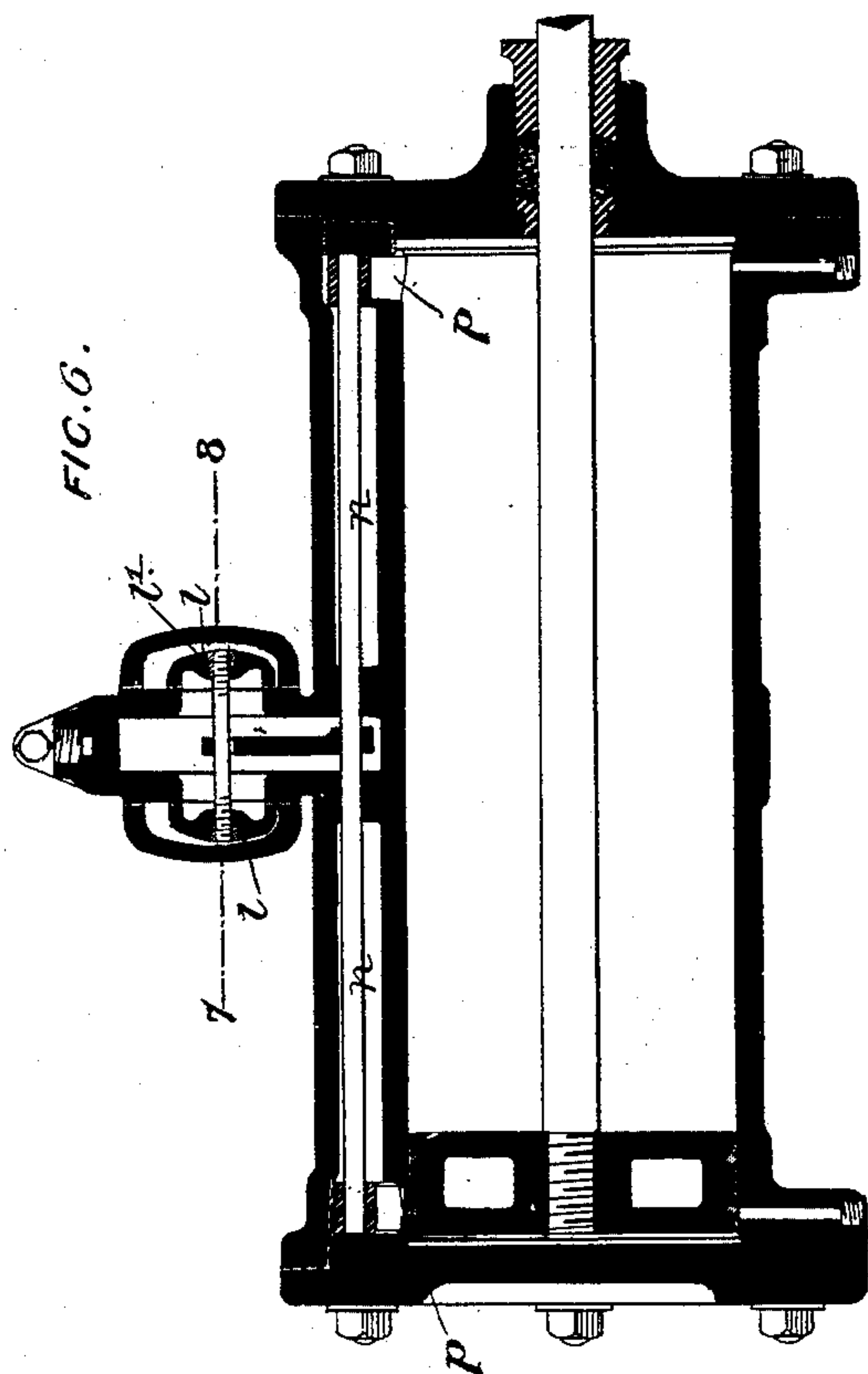
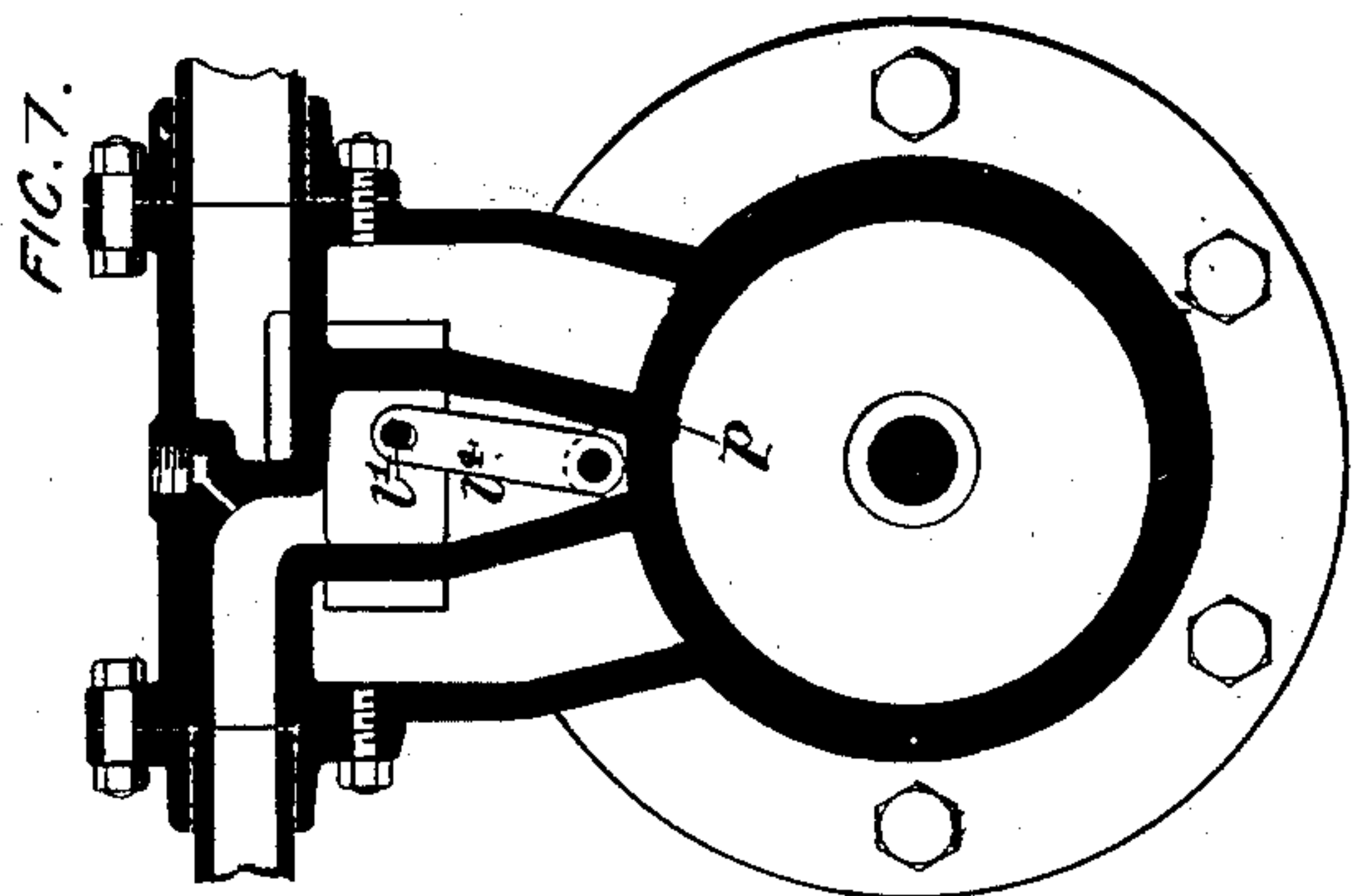
(No Model.)

2 Sheets—Sheet 2.

T. H. WARD.
BALANCED VALVE.

No. 333,799.

Patented Jan. 5, 1886.



WITNESSES:
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UNITED STATES PATENT OFFICE.

THOMAS H. WARD, OF TIPTON, COUNTY OF STAFFORD, ENGLAND.

BALANCED VALVE.

SPECIFICATION forming part of Letters Patent No. 333,799, dated January 5, 1886.

Application filed July 24, 1882. Serial No. 67,579. (No model.) Patented in England October 25, 1881, No. 4,672.

To all whom it may concern:

Be it known that I, THOMAS HENRY WARD, a subject of the Queen of Great Britain and Ireland, and a resident of Tipton, county of Stafford, England, have invented certain Improvements in Balanced Valves, (for which I have obtained British Letters Patent No. 4,672, dated October 25, 1881,) of which the following is a specification.

My invention consists in certain improvements in the construction of balanced or equilibrium slide-valves for steam-engines, as fully described hereinafter.

In the accompanying drawings, Figure 1 is a longitudinal section of a steam-cylinder provided with my improvements. Fig. 2 is a sectional plan through the valve-chest. Fig. 3 is a transverse section of the cylinder and valve-chest. Fig. 4 is a sectional view, drawn to an enlarged scale, of the valve-chest. Fig. 5 is a corresponding transverse section. Fig. 6 is a longitudinal section of a steam-cylinder provided with a modified form of my improved equilibrium-valve. Fig. 7 is a transverse section of the same, and Fig. 8 is a sectional plan through the valve-chest.

In Figs. 1 and 2 the valve is shown in one position, and in Fig. 4 it is shown in the opposite position, while in Figs. 3 and 5 the valve is supposed to be in mid-position.

My improved valve is balanced in the manner hereinafter fully described, so that it shall be in equilibrium, and therefore be actuated with less wear and tear of its parts and slide-faces and of the actuating device.

Upon the cylinder K, Figs. 1 to 5, is the part or casting k , in which are formed the passage k' , communicating with the inlet for the motive fluid, and the passage k^2 for the exhaust, and also the ports k^3 for the alternate admission and exhaust of the motive fluid to and from the cylinder at opposite sides of the piston K². The exhaust-passage k^2 is continued from the exhaust-pipe between the exterior of the valves l and the interior of the covers k^4 , which are secured in place by tie-bolts k^5 , and the inlet is continued from the inlet-pipe to the cylinder between the ports k^3 , through the interior of the valves l . I bring the steam into the center port and through the ports k^3 alternately, the said ports being alter-

nately covered at both sides by means of the two valves l , which are connected together by the tie-rod l' , having right and left hand screw-threads formed at opposite ends, which engage with corresponding screws formed in the collars l^2 of the said valves, which valves thus move as one, being actuated, by preference, by admitting steam at the center port. Where the steam is admitted at the center port, the movement of the valve is obtained in a manner the reverse of that in which the movement of the ordinary slide-valve is obtained.

A convenient arrangement for effecting the movement of the two parts of the valve by mechanism arranged for being acted upon by the piston, as described in my British Patent No. 1,650 of 1881, is shown in the drawings. The tie-rod l' , which connects the two parts of the valve l , is mounted in a block, l^3 , capable of sliding in guides in a lever, l^4 , turning upon the center pin, l^5 , carried by the plate l^6 . The other end of the said lever is formed with a semicircular series of teeth, which engage with teeth or projections formed on the rod, which is moved to and fro by the piston. The valve l can be adjusted by means of the center bolt, l' , while the steam is on until the steam leaking through their faces is stopped, so that the greatest nicety of adjustment can be effected by sight. When this is accomplished, a perfect balance-valve is the result. The engine or steam-pump can now be worked on trial without any covering to the valves, so that the working of the valves can be actually watched and set. The covers k^4 are then bolted on after all is in order, the said covers serving, as aforesaid, as the chamber for the passage of the exhaust-steam which is conducted through the ports k^3 , as they are alternately opened thereto by the movement of the piston, the motive fluid passing to the cylinder by the other of the ports, k^3 , which are open to the interiors of the valves l . When this balance-valve l is adjusted properly, the wear and tear in the shooting bolts described in my said former British patent is very materially diminished, owing to the equilibrium of the said valve l . It is obvious that the action may, if desired, be reversed by bringing the steam on the outside and the exhaust into the center, in which case the center bolt acts

asa strut, instead of as a tie, but the arrangement previously described is preferable. The necessity of reversing the action of the valve 11 by the lever 14 may be avoided by bringing the off port round to the on side.

If desired, this balance-valve may be arranged so that the direction of its stroke may be at right angles to the direction of the piston. This may be effected by the arrangement illustrated in Figs. 6, 7, and 8. The rod, which is actuated from opposite sides of the piston, is provided at the opposite ends with inclined projections *p*, fixed thereto, and projecting from opposite sides thereof—that is to say, in opposite directions—the said rod also having fixed thereto the lever 14, which is connected at its upper end to the tie-rod 17 of the valve 11. As the piston alternately bears upon the projections *p*, it will give an oscillating motion to the rod, which carries the said projections,

and consequently to the lever 14, which will thus move the valve 11 to and fro in a plane at right angles to that in which the piston travels.

I claim as my invention—

The combination of the valve-chest of a steam-engine and two valve-seats, with a valve made in two parts, united by a tie-rod, a lever, *L*, connected to the tie-rod, and a rod adapted to be operated by the piston, and controlling said lever, substantially as set forth.

In witness whereof I have signed my name to this specification in the presence of subscribing witnesses.

T. H. WARD.

Witnesses:

OLIVER HOWL,
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THOMAS CRESSWELL,
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